ADT PLM

Programmer's Learning Machine

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COAST meeting, 2016-02-12

Outline

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Presentation of PLM

Purposes

- Application to learn programming.

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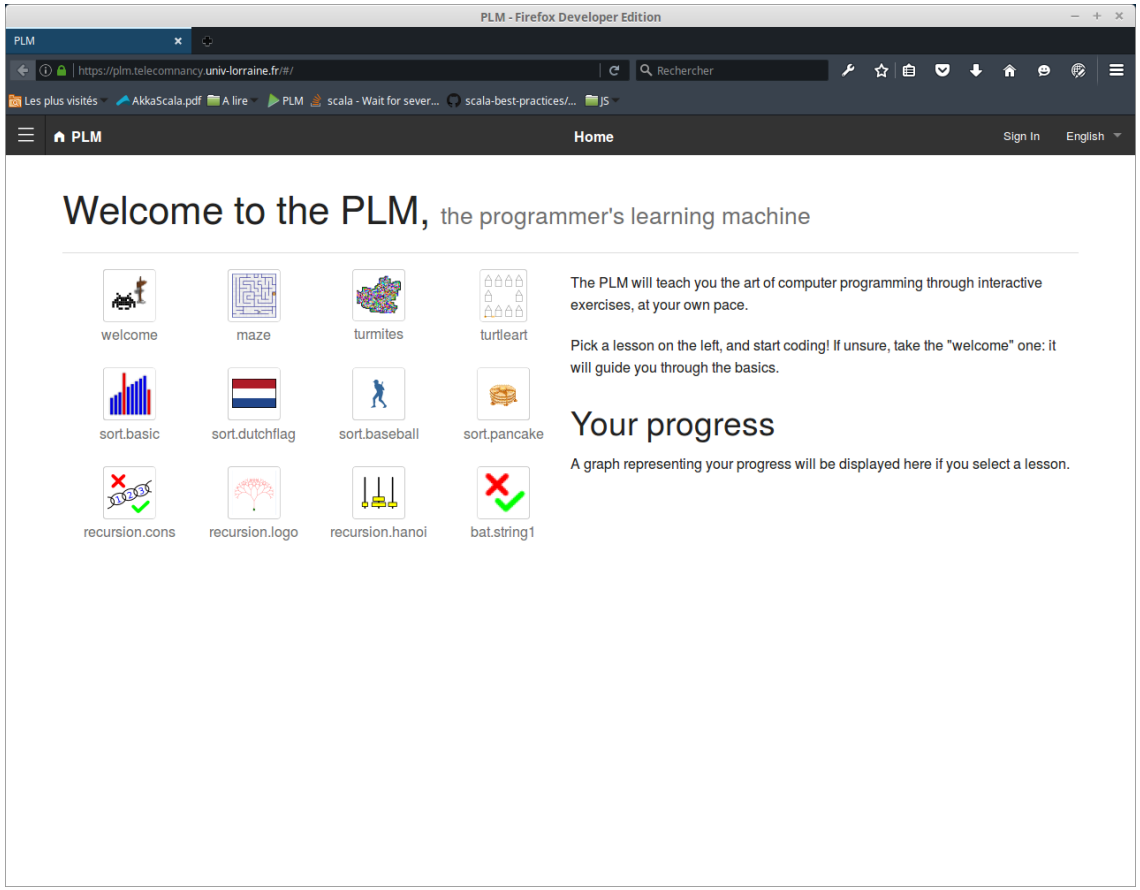
- Application to learn programming.
- Allows students to progress at their own speed...
- ... while the teacher helps the ones having trouble.
- Used at TELECOM Nancy since 2008.

Presentation of PLM

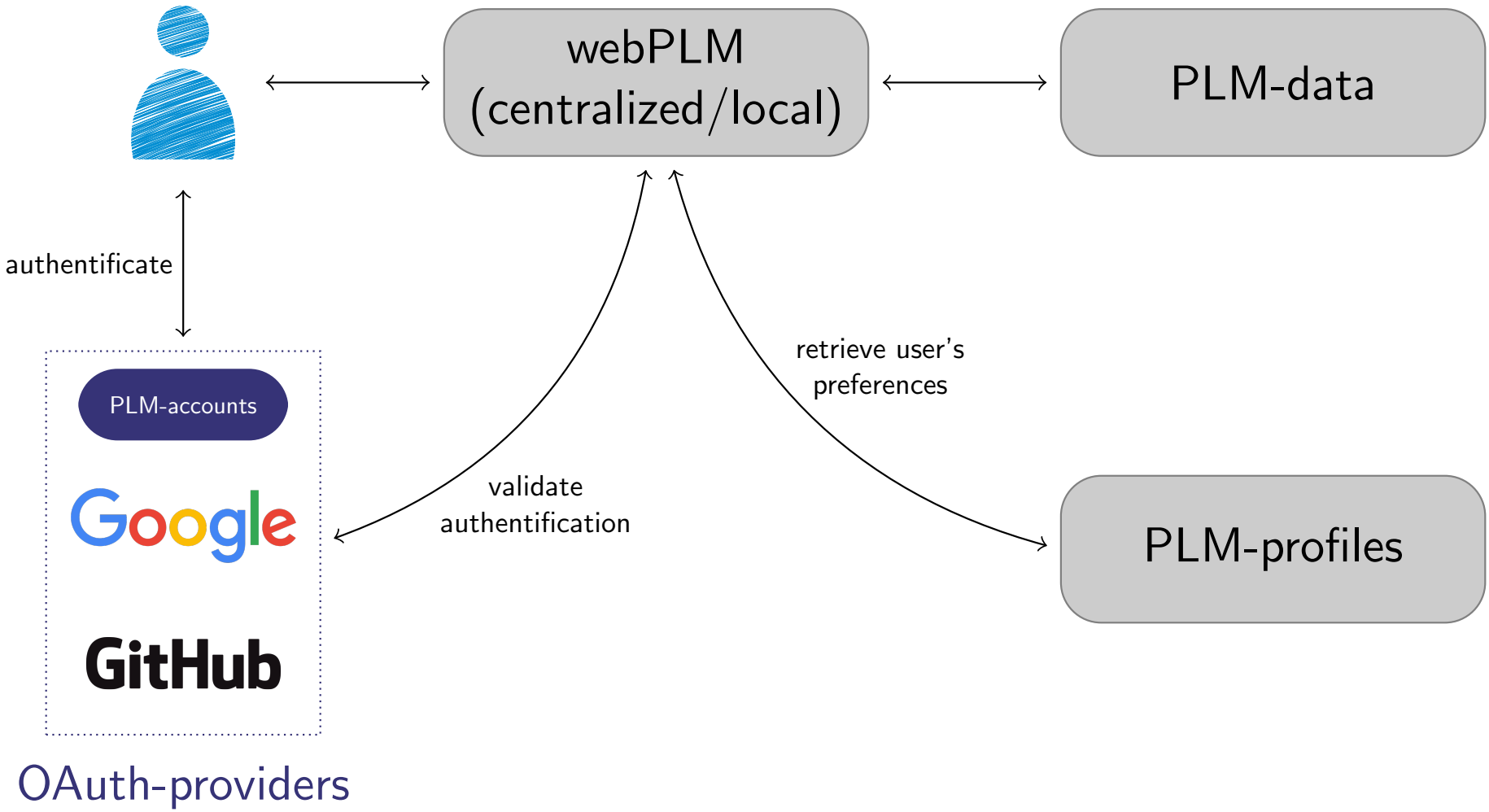
Quick demo



- Available at `https://plm.telecomnancy.univ-lorraine.fr`

Presentation of PLM

Application's architecture



- Keep track of the users' progress...

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- ... using a git repository

Presentation of PLM

How does it work?

- Store users' code versions

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- Store users' actions as commit messages

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- Working in anonymous branches
- Branches pushed to a **GitHub** repo

Presentation of PLM

Desired users

- Students obviously
  - More teaching content
  - Gamification

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  - Gamification
- But also teachers
  - Keep track of the students' progress
  - Adapt content to their needs
  - Able to add their own exercises

Presentation of PLM

Desired users

- Students obviously
  - More teaching content
  - Gamification
- But also teachers
  - Keep track of the students' progress
  - Adapt content to their needs
  - Able to add their own exercises
- And researchers
  - To an experimental teaching platform
  - How to detect students having difficulties?
  - What are the most common errors?

Outline

To a web app

Evolution of the project

- Formerly a fat client
  - Written in Java

To a web app

Evolution of the project

- Formerly a fat client
  - Written in Java
- Switch to a web application
  - Server implemented in Scala using *PlayFramework*
  - User interface written in Javascript using *AngularJS* and *Foundation*

To a web app

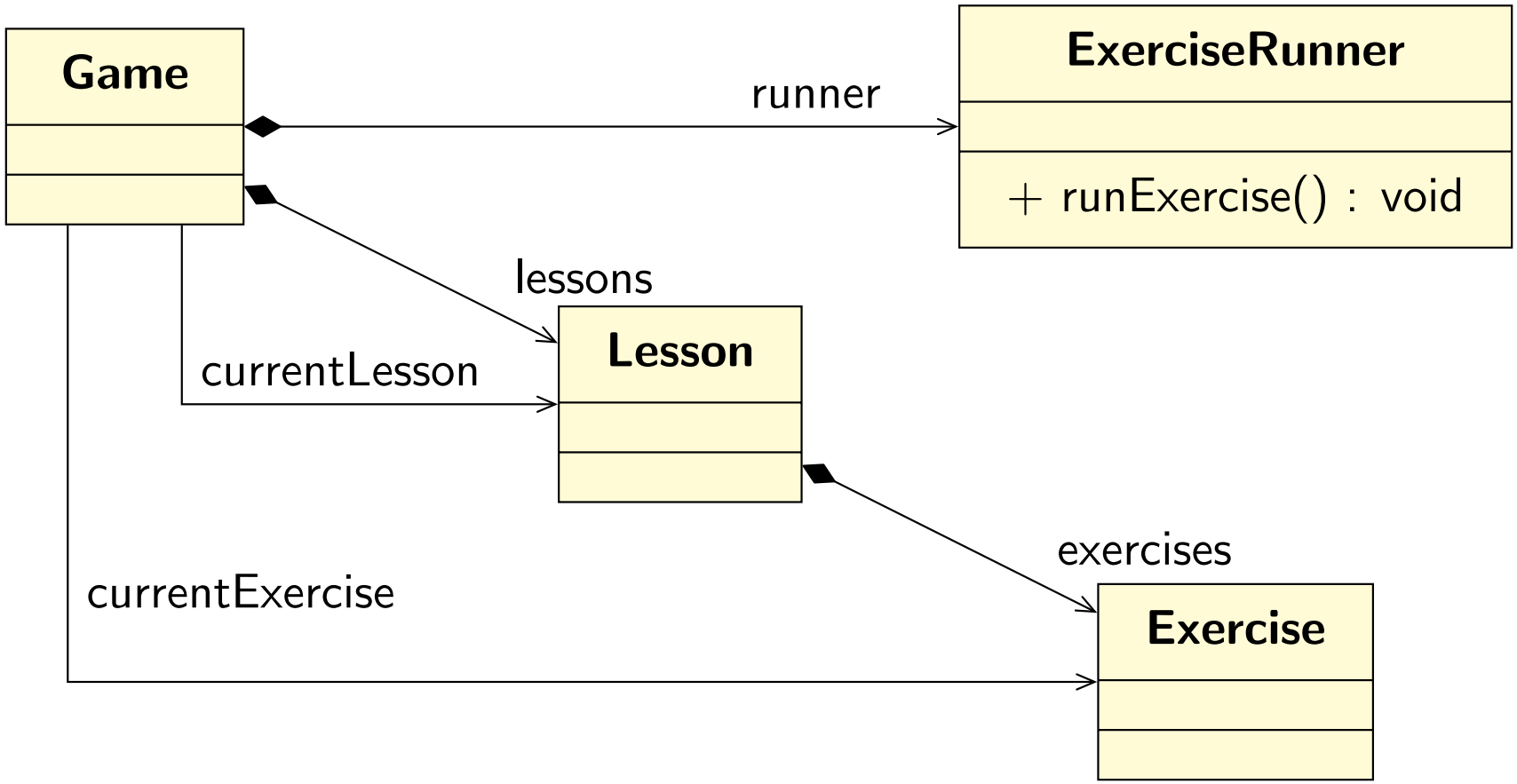
Motivations

- Want to switch to SaaS[1]
  - Easy to use
  - Easy to update
  - Easy to track usage data
- More user-friendly
- Aim to setup SPOC[2] and MOOC[3]

- But don't have the time and means for a reboot

[1] Software as a Service
[2] Small Private Online Course
[3] Massive Open Online Course

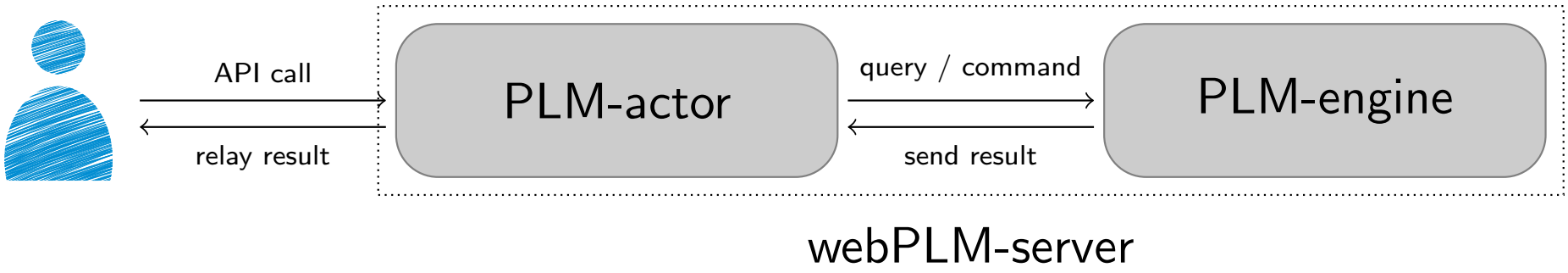
- Implemented a headless version of PLM: *PLM-engine*
  - Provide all PLM's content and methods
  - But without a user interface



To a web app

Implementing the server

- Designed an API over PLM-engine



To a web app

Dealing with multi-user

- **Game** is a *singleton*

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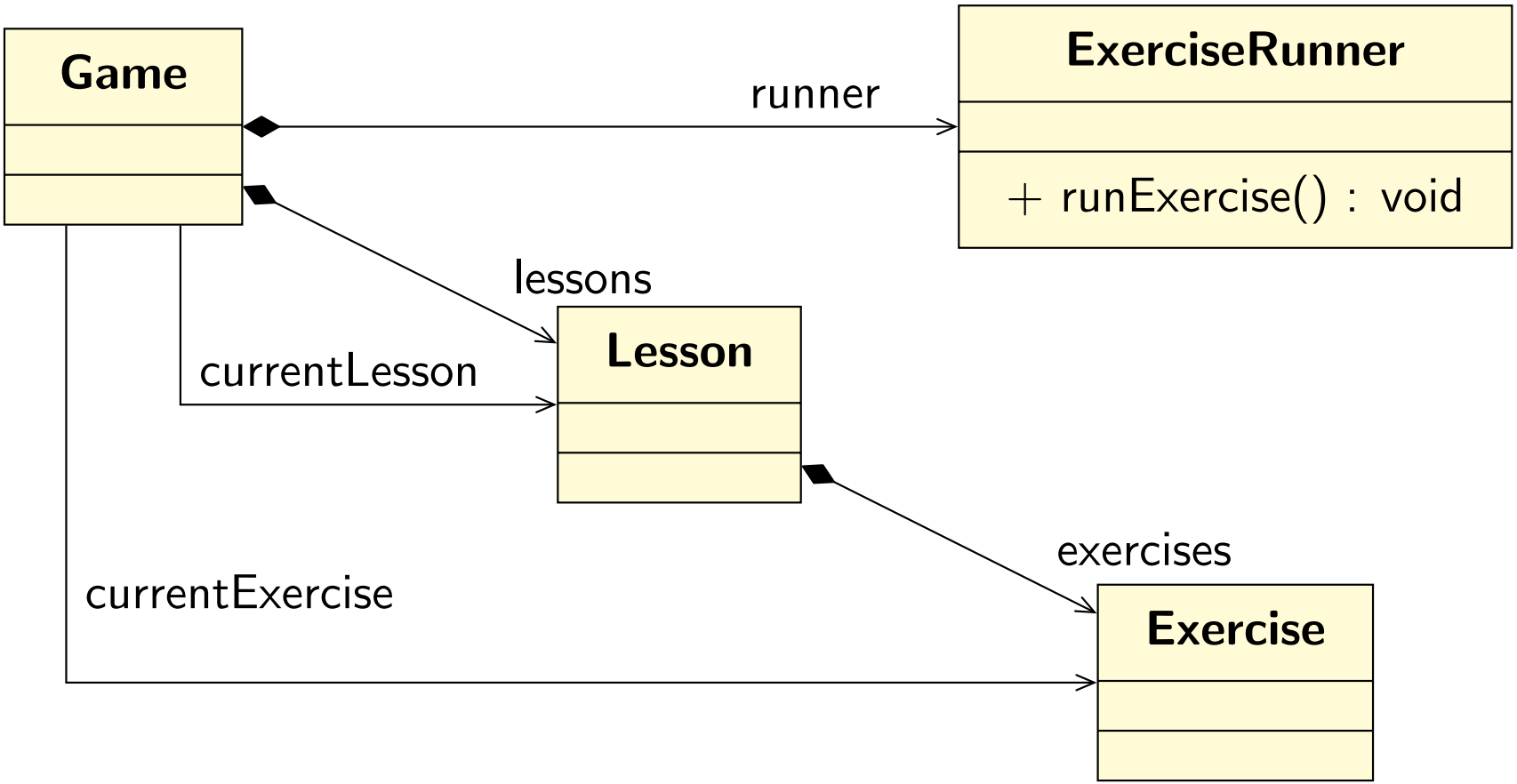
- Do you remember that we store the user's session in **Game**?



- Need to refactor all components accessing it

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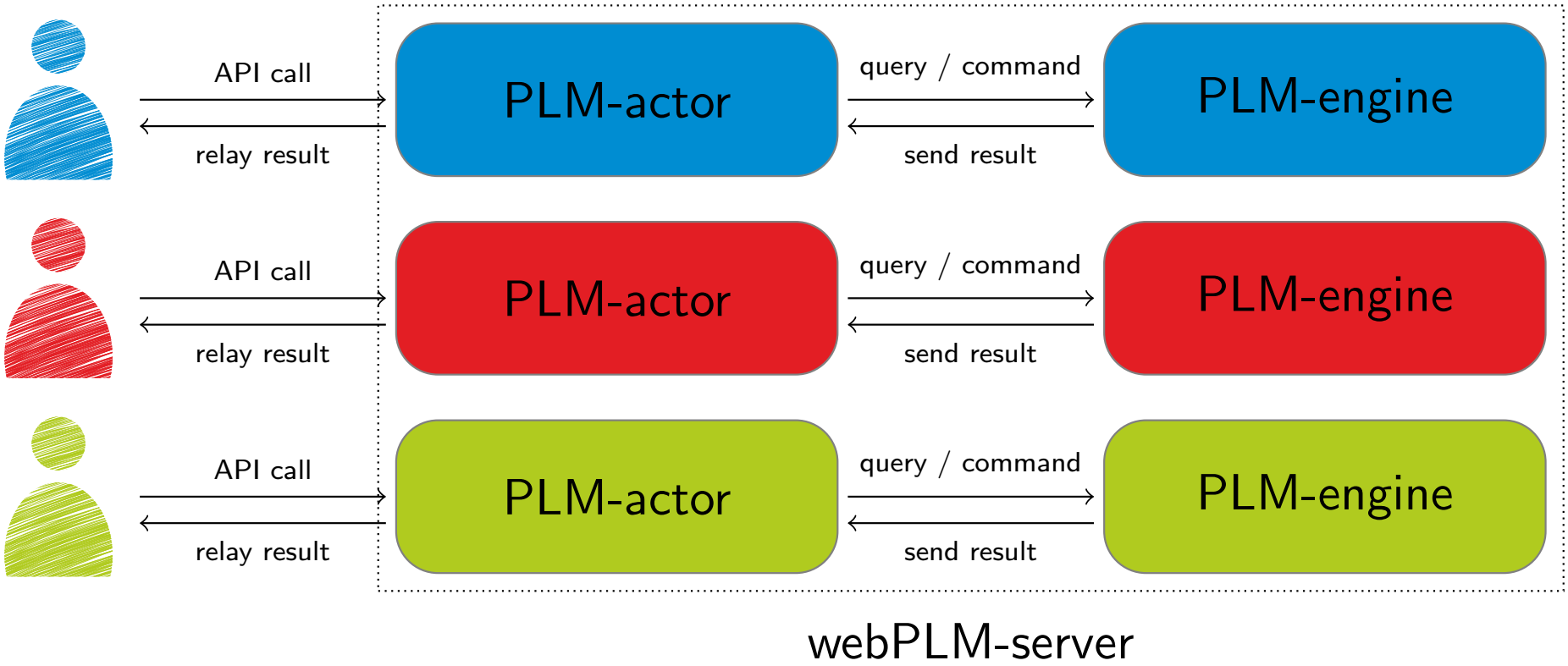
- Let's save it for later!
- Add **Game** as constructor's parameter

To a web app

Multi-user scenario



To a web app

Results

- Build quickly a web server from the fat client...
- ... but still need to address some design issues

Outline

Assessment of user's code

Limits

- Run on the same machine, same JVM

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  - Infinite loops

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- And from more malicious "mistakes"?
  - Infinite thread creation
  - Endless file creation

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- And from *System.exit(whatever)*?

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- How to protect ourselves from users' rookie mistakes?
  - Infinite loops
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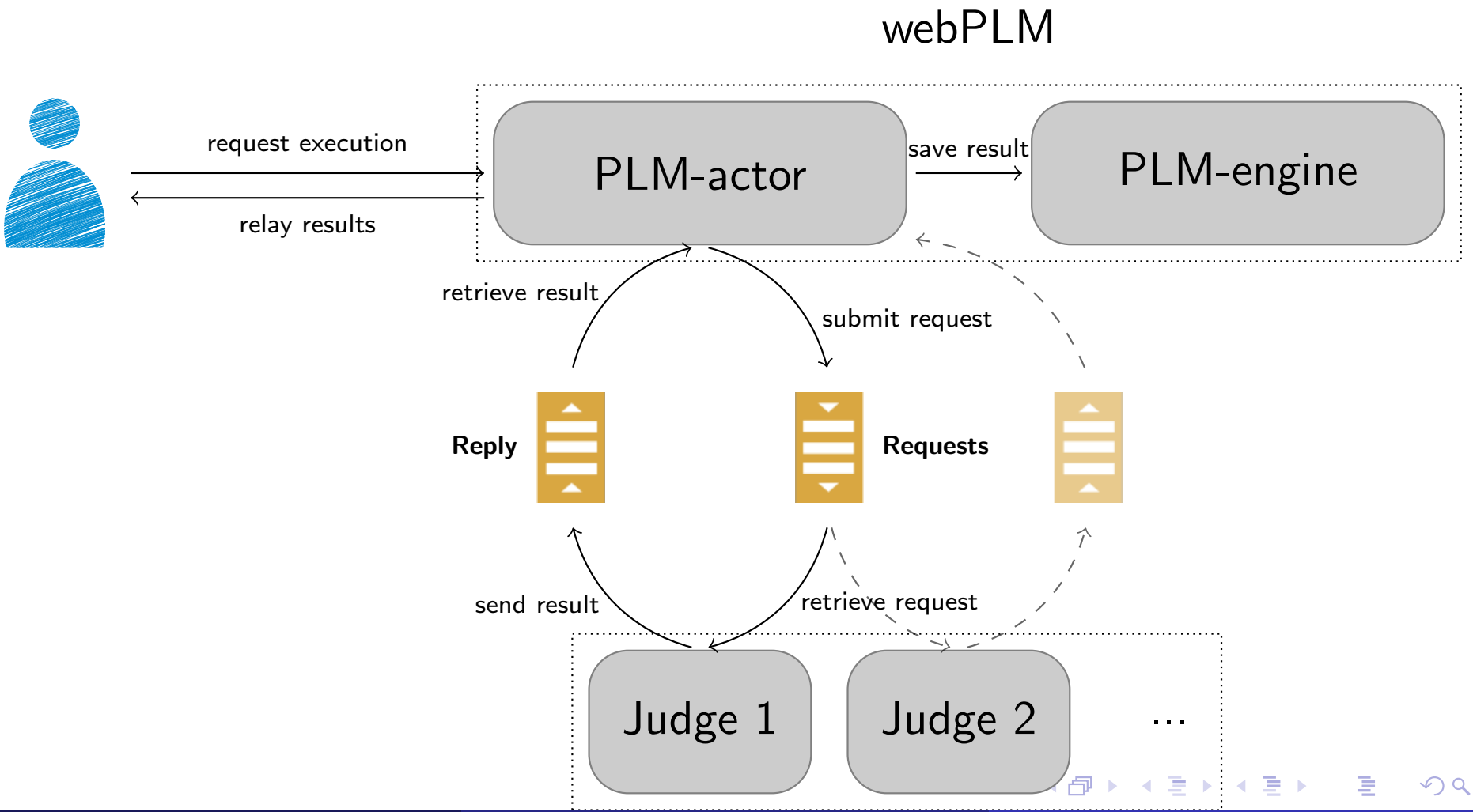
- And from *System.exit(whatever)*?
- Scalability issues

Assessment of user's code

Chosen solution

- Delegate execution to workers



Assessment of user's code

Pros and cons

- Pros:
  - Allow to run code without impacting webPLM's performances
  - Meet the scalability requirements

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- Pros:
  - Allow to run code without impacting webPLM's performances
  - Meet the scalability requirements
- Cons:
  - Make sure to use the right version of PLM-engine
  - Need to deploy them easily
  - Should restart them after each execution
  - Have to restrict their resources usage

Assessment of user's code

Docker

- Lightweight virtualization tool
- Build image of your application
- Run containers based on images

Assessment of user's code

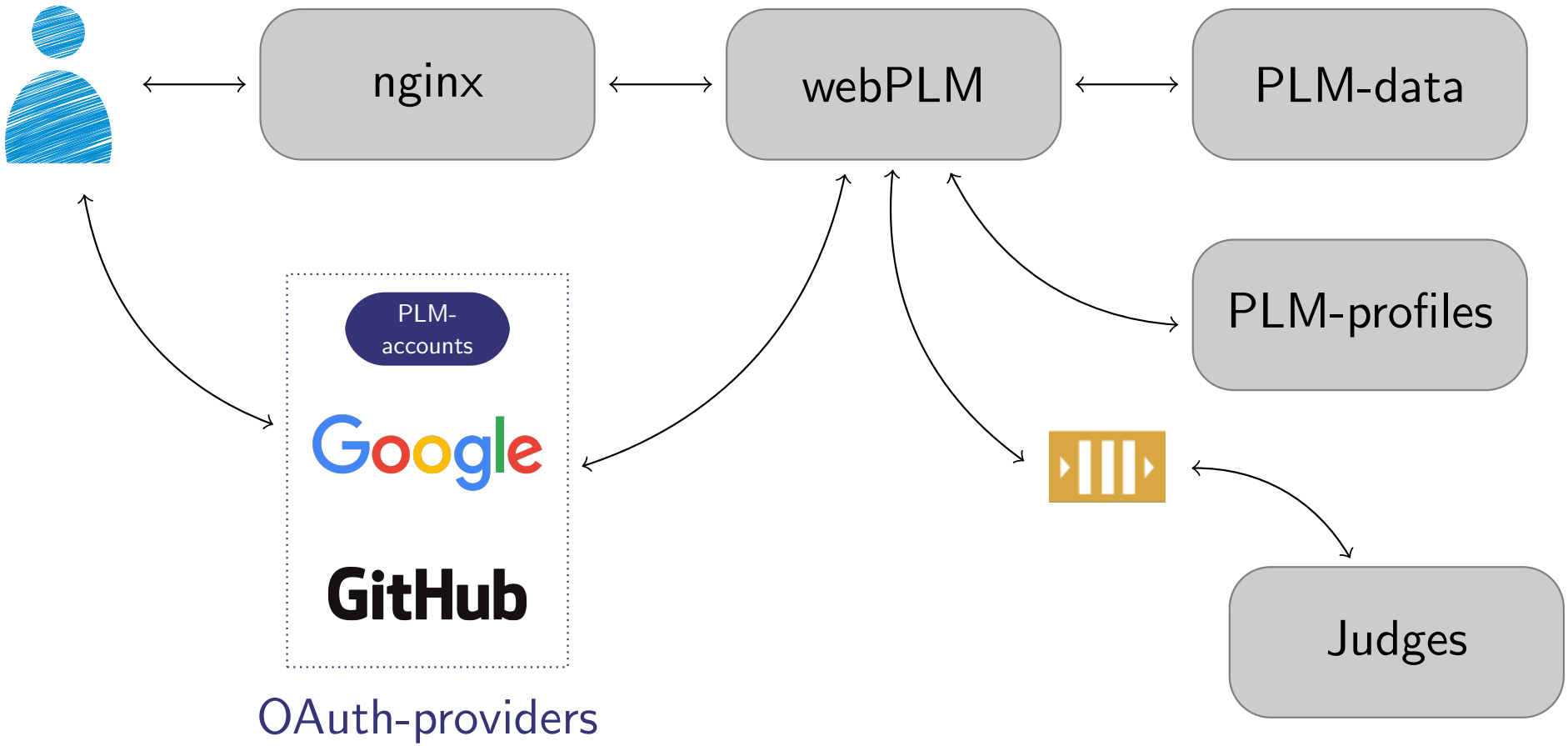
In our case

- Deploy easily all components
- Restart judges automatically
- Limit judges' ressources

Outline

Result

Current architecture



Result

Live-session in TELECOM Nancy

- Used in TELECOM Nancy in September 2015
- 30 hours of live testing with 100 students

Result

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- Engine is (almost) working fine...
- ... but user experience needs to be improved!

Result

Live-session in TELECOM Nancy

- Scalability issues:
  - Work well with small exercises
  - Can't cope with workload of larger exercises

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Live-session in TELECOM Nancy

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Result

Live-session in TELECOM Nancy

- Scalability issues:
  - Work well with small exercises
  - Can't cope with workload of larger exercises
- No tools for monitoring set up...
- ... so the bottleneck is unknown.

Outline

Current tasks

Refactor PLM-engine

- Want to remove lessons and exercises from PLM-engine, from **Game**
  - Need to release new version of webPLM and Judge for each change
  - Heavy and error prone workflow
  - Want to implement an exercise editor

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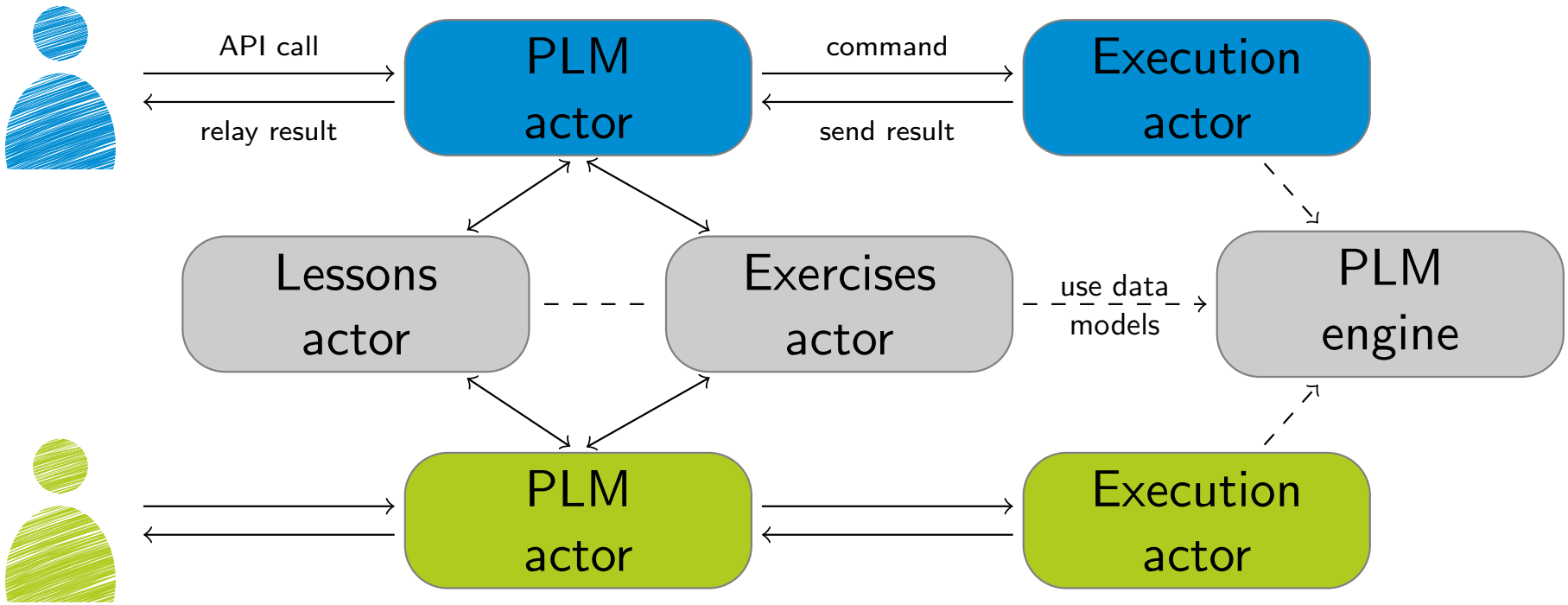
Current work

WIP architecture



Current tasks

Solve performance issues

- Set up some monitoring tools
- Perform some load testing to identify the bottleneck

Next steps

Sneak peek from the TODO list

- Integrate interns' contributions
- Set up Continuous Deployment
- Support additional programming languages
- Implement a debug mode similar to popular IDEs' ones
- Add features to help teachers to supervise their students
- ...

Questions

Thanks for your attention, any questions?